

MIXTURES OF MATERIALS

THIS INVENTION relates to mixtures of materials.

According to the invention, a settable mixture comprises polybutadiene, a flow-enhancing liquid, and substantially dry particulate material, the latter containing no more than 2% Aluminium Oxide, and no more than 1% Ferrous Oxide, the percentages being by weight of particulate material.

having no more than 2% water content and

The flow-enhancing liquid may be a flow-enhancing solvent.

The particulate material may comprise dry sand being at least 90% silica sand; ground or crushed glass, for example, including recycled glass and ground or crushed glass products which may include some non-glass material; ground slate or other mineral, for example, granite or stone. However, preferably the particulate material as a whole should not contain more than 1.4% by weight of Aluminium Oxide, nor more than 0.5% by weight of Ferrous Oxide.

The particulate material may be a mixture of different materials.

The polybutadiene may be in liquid form.

The settable mixture may contain a re-doriser.

The proportion of the re-odoriser may be between 0.001% and 5% by weight of the settable mixture.

An example of a flow-enhancing liquid is Shellsol D25SBP 140/165.

The settable mixture is not adhesive, i.e. it is not tacky to the touch and can, for example, be placed on laid tiles and paving and swept into the gaps using a brush or the like, or placed directly into the gaps between the tiles or paving to act as a filler without sticking to the surface of the tiles or paving.

The particles in the particulate material may be of uniform size or different sizes.

There may be additions, for example, colourants and/or reinforcing materials e.g. synthetic or carbon fibres.

Suitable re-odorisers are those sold under the name FRAG 6M 3467 by Gale and Mount Limited, Manchester, England and MASQUADOR TF, by Protex Limited, Leeds, England.

The sand is preferably of special fraction size predominantly in the range of grain size 0.01mm to 0.85mm and is dried to have a maximum 2% water content by weight absorbed from the atmosphere after drying.

The mixture may be bagged so as to be contained in an essentially oxygen-free atmosphere.

The invention includes paving, flooring and wall elements secured or spaced apart by said mixture when set.

The invention may be performed in various ways and some specific embodiments with possible modifications will now be described by way of example.

The invention provides a mixture which is settable on exposure to atmosphere (oxygen) and can be used indoors or outdoors for use as a screed or for pointing paving or flooring e.g. stones, cobbles, setts, tiles, concrete or clay or stone slabs; or for pointing wall tiles or bricks.

In general the mixture comprises polybutadiene, a flow-enhancing liquid and particulate material. The polybutadiene is provided in liquid form prior to mixing.

The particulate material which should be substantially dry, may, for example, comprise dry sand; ground or crushed glass, for example, including recycled glass and ground or crushed television tubes or fluorescent tubes which may include some non-glass material; ground slate or other mineral for example granite, stone; or a mixture of materials.

The flow-enhancing liquid, in addition to improving

workability of the mixture, also improves cross-linking strengths within the mixture and provides for adequate flexural and compressive strengths in the compound after setting, making it particularly suitable for jointing and screeding in areas where the paving or the like comes under extreme stresses. It shall occupy between 0.1% and 0.4%, by volume, of the settable mixture.

The flow-enhancing liquid shall preferably have an evaporation index to DIN 53170 of less than 50. It shall also preferably be a de-aromatised hydrocarbon. An example is Shellsol D25 SBP 140/165, having an evaporation index of 20.

If glass particles are included in the particulate material, these may be of uniform size or different sizes.

The term dry sand includes sand which has been dried and has then absorbed some moisture from the atmosphere, but preferably no greater than 2% by weight.

A particularly suitable form of liquid polybutadiene is that sold under the name Univest-S by Promacon Dr. Schirm GmbH, of Dortmund, Germany, and ideally occupies the settable mixture in an amount of between 1.5% and 6% by volume, and preferably between 2% and 4% by volume.

A particularly preferred sand is kiln dried silica sand of special fraction size and having a maximum of 1.4% of Aluminium

Oxide, a maximum of 0.5% Ferrous Oxide and a maximum of 1.5% combined Potassium Oxide and Sodium Oxide, these percentages being by weight of the sand.

The fraction size should be a good mix predominantly within the range 0.01mm to 0.85mm. At least 40% of the sand should preferably average 0.26mm in size. Rounded or sub-rounded grains can be used but a predominance of grains having an angular or sub-angular shape is preferred.

Examples of suitable settable mixtures are:-

1.	2% - 4%	By volume	Polybutadiene
	0.1-0.4%	By volume	Shellsol D25
	0.007%	By volume	Re-Odoriser
	Balance %	By volume	Kiln dried silica sand special fraction size (as specified above)
2.	2% - 4%	By volume	Polybutadiene
	0.1-0.4%	By volume	Shellsol D25
	1% - 5%	By volume	Synthetic or carbon fibres
	0.007%	By volume	Re-Odoriser
	Balance %	By volume	Kiln dried silica sand special fraction size (as specified above)
3.	2% - 4%	By volume	Polybutadiene
	0.1-0.4%	By volume	Shellsol D25
	0.1%-0.5%	By volume	Dry colour pigment
	0.007%	By volume	Re-Odoriser
	Balance %	By volume	Kiln dried silica sand special fraction size (as specified above)
4.	2% - 4%	By volume	Polybutadiene
	0.1-0.4%	By volume	Shellsol D25
	1% - 5%	By volume	Synthetic or carbon fibres
	0.1%-0.5%	By volume	Dry colour pigment
	0.007%	By volume	Re-Odoriser
	Balance %	By volume	Kiln dried silica sand special fraction size (as specified above)

The above examples contain sand as the particulate filler but other materials as referred to above may be used with the sand.

By ensuring that the sand content of the mixture is predominantly silica sand i.e. having a Silicon Oxide content of at least 90%, a number of advantages occur, namely:-

- a) staining of adjacent paving surfaces is minimised or eliminated;
- b) a chemical reaction within the bagged mixture which can retard its setting time, is prevented (this reaction may be experienced with sands falling outside the limits specified);
- c) any such chemical reaction which could also significantly reduce the shelf life of the bagged mixture, is avoided;
- d) keeping the mixture dry for a considerable time after application is not necessary since the setting time is kept as short as possible;
- e) a reduced setting time enables the mixture to be used to fill deeper joints between paving without the risk of ingress of moisture from the ground beneath.

The re-odoriser is required particularly for use in internal and confined places but is also suitable for external applications when the polybutadiene alone can have a quite unpleasant odour.

The mixture may contain a colourant for ease of identity or for aesthetic purposes.

The mixing is done quickly and preferably by machine, to avoid or limit any setting which might occur due to heat and exposure to atmospheric oxygen.

After mixing, the mixture is placed in bags or other convenient containers, and vacuum packed to remove oxygen (air) and thus suspend the setting process in a substantially oxygen-free atmosphere until the bag is opened. The mixture may be contained in convenient amounts. The bags are preferably housed within impact-resistant boxes, to prevent perforation and for ease of transportation and storage.

If required, to maintain flexibility in the bag, the extracted air may be replaced by a small volume of an inert gas such as carbon dioxide or nitrogen.